CHEMICAL & ENGINEERING NEWS

C&EN

JULY 18, 1994

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FINAL PROGRAM--ACS NATIONAL MEETING IN WASHINGTON, D.C. PAGE 53

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FLUORESCENCE IMAGING

Technique tracks messenger molecules in living cells

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CHEMICAL & ENGINEERING NEWS

C&EN

JULY 18, 1994

NEWS OF THE WEEK

■ The cost of producing ethylene may be lowered by a new process that replaces energy-intensive demethanization and cryogenic separations with a solvent absorption process. **Page 6**

■ U.S. government agrees to give France's Pasteur Institute a larger share of AIDS test royalties—and acknowledges that NIH scientists used a Pasteur-provided virus to develop the U.S. test. **Page 7**

■ Monsanto and Chevron Chemical are sued for age and racial discrimination by 41 former employees of Chevron's Ortho division, which was purchased by Monsanto. **Page 7**

■ Hercules, looking to focus on specialty chemicals, arranges sale of its aerospace businesses to Alliant Techsystems. **Page 8**

■ China, the U.K., and the U.S. garner top three rankings in 26th International Chemistry Olympiad—with the U.S. team winning two gold, one silver, and one bronze medal. **Page 8**

■ Formosa Plastics signs agreement with regulatory and environmental groups to fund study aimed at achieving zero discharge in wastewater from its plant on the Gulf Coast. **Page 9**

COVER: Fluorescence imaging shows a cytotoxic T lymphocyte killing a target cell with an overdose of Ca^{2+}. Photo courtesy of Marc Poenie et al., *EMBO Journal*, 6, 223, (1987); reprinted by permission of Oxford University Press

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BUSINESS

Engineering firms, contractors say alliances are crucial to success in developing new business as their clients, including chemical companies, cut back on capital expenditures. **Page 14**

Basofil, a new high-performance fiber to be introduced by BASF in 1996, will meet stiff competition in the crowded market for heat- and flame-resistant fibers. **Page 17**

GOVERNMENT

Antidumping laws, countervailing duties, and fast-track negotiating authority are some issues Congress, Administration must resolve to pass legislation to implement GATT trade pact. **Page 21**

Council on Competitiveness index report notes that U.S. economy is stronger but that major challenges still lie ahead. **Page 22**

SCIENCE/TECHNOLOGY

Interference with melatonin, disruption of cell communication at gap junctions are some hypotheses proposed to explain the complex physiological effects of electric and magnetic fields. **Page 27**

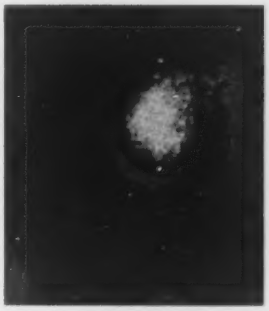
ACS NEWS

ACS Council will consider petitions to amend the society's governing documents on elections and membership requirements when it meets next month in Washington, D.C. **Page 46**

FINAL PROGRAM

ACS national meeting in Washington, D.C., will include nearly 5,200 papers in more than 550 technical sessions; exposition will comprise about 385 booths, more than 230 exhibitors. **Page 53**

SPECIAL REPORT



Advances in the design and synthesis of fluorescent molecules that reversibly bind chemical messengers in living cells allow researchers to observe the dynamics of a cell's internal biochemistry. Page 34

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LETTERS

Iron-age catalysis

The April 18 issue of C&EN (page 22) continues the currently popular story of the great contribution of catalysis to environmentally benign chemical process design. I fear that the concept is being oversold at the expense of scientific credibility and integrity.

For example, a chart on page 24 compares the catalytic and the conventional (presumably noncatalytic) routes for the preparation of hydroquinone. Unfortunately, the conventional method has three catalytic steps: the acid-catalyzed nitration of benzene to nitrobenzene, the catalytic hydrogenation of nitrobenzene to aniline, and the catalytic hydrogenation of quinone to hydroquinone.

The two hydrogenations are quaintly, and misleadingly, shown in the chart as reductions with iron and hydrochloric acid. Only an ancient catalytic chemist like myself could recall when iron and hydrochloric acid were used industrially for such purposes!

Harold Greenfield
HGV Consulting Co.
Green Valley, Ariz.

Cut short

Michael Heylin's interesting editorial (C&EN, May 9, page 3) on common usage of the word "chemical" to mean synthetic chemical throws a new light on the continuing discussion in C&EN (spiritual versus chemical was suggested by A. R. Paiton [C&EN, May 30, page 3]). Heylin rightly points out that this usage "is a cultural, linguistic thing."

The problem occurs because we often shorten expressions by throwing away the more descriptive parts. Thus a graphite-reinforced tennis racket is advertised as 100% graphite. And because the expression "explosive bomb" has been shortened to simply bomb, chemists must be careful about using the word bomb to describe a reaction vessel.

Of course, this sort of thing is not limited to chemistry. Execution of the death penalty is shortened to execution. Wholewheat bread becomes wheat bread (as opposed to white bread, which, presumably, is not made of wheat), and the United States of America is shortened to America.

Alan R. Miller
Professor of Metallurgy
New Mexico Tech
Socorro, N.M.

A pause on environmental policy

In its report on dioxin, the Environmental Protection Agency makes an astounding about-face on cancer risk (C&EN, May 16, page 36). After 30 years during which cancer risks have driven environmental policy out of any political control, EPA now finds there are no cancer risks, at least for dioxin. Tens of billions of dollars in mandated spending and a thousand new rules in 1993 alone have no other justification than the controversial cancer risks that EPA has been calculating.

Instead, EPA now cites health effects on fetal development and the immune system. But fetal and immune risk cannot soon play the regulatory role that cancer risk has played and probably never will. Any quantitative fetal risk assessment would require "assumptions" as controversial as those currently used in "quantitative cancer risk assessment." Those assumptions are now severely criticized. Without them, there is no fetal risk of dioxin in humans just as there never was a cancer risk.

Congress now struggles to reclaim some control over environmental policy, which it lost with assumed risks. By coincidence, the Superfund reauthorization cleared its first Congressional hurdle on the same day that EPA dumped dioxin cancer risk. Many consider Superfund the worst piece of legislation ever passed by Congress because it legitimized the assumption of risks. This time around, Congress should pause before jumping and ponder the wisdom of a policy based on risks that exist one day and are gone the next.

We recommend that Congress suspend Superfund and related laws for five years so that the public and elected officials can absorb the dioxin fiasco. This is a time for

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Tight Chemical Market Spurs New Services At Engineering Firms

■ ***Alliances with clients and competitors, plus global computer networks, boost contractors' opportunities for business development***

Susan J. Ainsworth, C&EN Houston

These days, going to the company board of directors to sell them on plans to build a new plant or upgrade an existing one ranks right up there with chemical business managers' most dreaded tasks. Over the past few years, in a chemical market characterized by wafer-thin profit margins and minuscule demand growth, chemical company management has spent much more time and energy devising ways to delay capital expenditures.

Not only has investment in new and existing plants dropped, but chemical companies also have whittled down their internal engineering departments and rigorously cut costs within those projects they do undertake. This scenario has, in turn, created challenges for the engineering and construction firms that serve the chemical, plastic, and pharmaceutical industries.

But many engineering and construction firms say they have found ways to create opportunity out of these challenges. Basically, contractors are becoming more attuned to companies' needs and moving quickly to meet them, even if it means extending themselves into new areas of service.

Most notably, contractors are teaming up with clients in alliances to take on any tasks chemical companies can no longer handle internally. They are also forming alliances with their competitors to meld expertise and create synergies that more precisely fit the client's needs. These firms are also creating global offices through information technology computer systems to better capture growth in the specific regions in which chemical companies are now expanding.

These new strategies benefit not only the engineering and construction firms that use them to the best advantage but also their chemical company clients, which are now enjoying a broader range of services and more value for their dollar. What's more, these market changes, made in the heat of the recessionary bust, will serve both client and contractor well as they anticipate recovery that they say will stop just short of another building boom.

"Business is spotty now, but I think [the number of projects] will begin to pick up across the board," says Harvey J. Rosenfeld, executive vice president of Houston-based John Brown Engineers & Constructors. "Our customers are becoming more bullish about investment, particularly in polymers. I'm convinced that two of our biggest polymer clients are going to come out of the downturn with a bang." Next year, John Brown expects to be bidding on a polyethylene plant for one of those companies and on a polypropylene unit for the other.

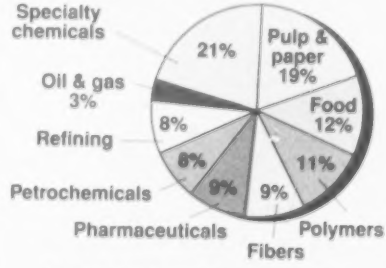
Jerry Oliver, vice president and manager of technology for Houston-based Bechtel Petroleum, Chemical & Industrial Co., has also observed increasing interest in plastics projects lately. Particularly hot are plans for polyethylene terephthalate, polyvinyl chloride, and purified terephthalic acid, which is used to produce polyester, he says.

Houston-based engineering firm M. W. Kellogg reports more activity further upstream—its area of expertise. "We don't see as many inquiries for new projects as we'd like to see, but [we] do have the perception that business is turning around, particularly on the ethylene side," says Martin J. Van Sickels, vice president and director of technology management at Kellogg. His colleague Rolf C. Nedelmann, director of sales administration, adds: "If our projections are right, we will see some ethylene capacity additions toward the second half of the 1990s. These expansions will probably be accomplished through debottlenecking of facilities built in the past decade rather than through building of new grassroots plants."

Kellogg's manager for market analysis and planning, Art Kelly, observes that the firm has seen a steady stream of environmental projects, many of which are driven by government regulations. For example, "We've prepared some environmental impact statements for our clients and helped them with analyses that are needed to ensure their compliance with the Clean Air Act." These mandatory expenditures have helped to broaden engineering firms' sales bases through the market downturn, when chemical companies could not justify expenditures on production plants.

The revenues engineering firms have lost to fewer expansion projects are being made up at least partly as they are asked to fill voids left by downsizing programs at chemical companies. For example, contractors are taking on project implementation, production design, and construction management—work that used to be

Specialty chemicals are a big construction market



1993 total for U.S. projects[a] = $47 billion

a For chemical and related process industries
Source: John Brown Engineers & Constructors

done by the engineering staffs of chemical companies.

Because contractors are becoming more intimately involved in chemical projects, clients are setting up alliances with engineering firms in which each party is more closely attuned and committed to the other's business goals. Among other things, the alliance guarantees that the client will have a trained work force when business starts to pick up again, says John Brown's Rosenfeld.

In addition to allowing chemical companies to stabilize their work force and cut fixed costs, "alliances give us an opportunity to better capitalize on engineering firms' strengths," says Vic Kleinfelter, engineering manager for design at Wilmington, Del.-based DuPont. "They can provide more value than they could have in the past." Alliances are more open, trusting, and performance-oriented than the partnerships DuPont set up with contractors back in the mid-1980s, he observes. Another difference: Alliance contractors are paid on the basis of the value they add to the clients' business rather than on the number of hours logged on a project.

Clients are asking their alliance contractors to be involved earlier in the process, too. "In the past," says Kleinfelter, "we might have given a contractor a set of specifications and drawings for a plant with instructions to build it at the lowest possible cost. Now, we want to bring the contractor in on the front end so we can utilize its expertise and its unique window on the outside world." Although a chemical company understands the basic chemical production process better than anyone, the engineering firm often can bring in new technologies for reducing emissions, capital costs, or energy consumption that are valuable as the process is scaled up, he says.

Kellogg's Nedelmann sees this trend, too. Clients "are coming to us even before they know whether the project will pan out, because they know that the contractor's expertise can significantly reduce a client's capital investment on a project."

DuPont's Kleinfelter adds: "There's no question that strategic alliances between chemical companies and engineering firms are on the rise. We are just beginning to tap all the opportunities."

Licensing alliances between chemical companies and engineering and construction firms are taking off too, because they can be mutually beneficial.

Mobil Chemical polyethylene unit in Beaumont, Tex., built by John Brown.

Licensing alliances help each partner leverage its resources to achieve business goals that would have been more difficult to achieve alone, says Jeffrey P. Reilly, manager of strategic business development for technology businesses in Houston for Bloomfield, N.J.-based ABB Lummus Crest. Through such an arrangement, companies can more successfully share skills and costs, gain access to new markets, or reduce a company's reaction time to uncertain events, he adds.

Chemical companies cannot afford to miss out on the revenue that a desirable technology can generate, but because they are operating with reduced internal staffs, they cannot get technology licensed out as efficiently as they used to, says Bechtel's Oliver. The obvious solution is to align with an engineering firm that can take on some of the engineering and licensing work.

Just last month, Kellogg signed an exclusive licensing agreement to market Dow Chemical's bisphenol A technology and build plants based on it. The Dow bisphenol A process provides a high-quality feed for making specialty polycarbonate products with the lowest yellowness index at both low capital and manufacturing costs. For Dow, the alliance represents an opportunity to generate new sales growth for a technology that has never been offered outside the company before. At the same time, it allows Kellogg to add to its other technology offerings in the phenol process chain.

"Traditionally, we have not worried much about getting into licensing alliances," says Oliver, "but now that we see that they represent a real revenue-generating opportunity, we are looking closely at whom we should be aligning with."

Engineering and construction firms are also teaming up with competitors to bring together services tailored specifically to prospective clients' needs. For example, in April, Brown & Root and Chemicals & Kinetics Technology International formed a strategic alliance to jointly offer their services to ethylene producers. Together, the partners will bring to the alliance ethylene production technologies that will allow them to build plants with the most reliable yield prediction and the lowest possible capital and energy requirements, according to Wilfred K. Lam, vice president for process technology at Brown & Root.

Teaming up with competitors can also give engineering and construction firms a stronger foothold in another part of the world. For example, earlier this month, Lebron Associates, a Puerto Rican architectural and engineering consulting firm, and John Brown entered into an exclusive working arrangement to provide the full range of engineering, construction, and validation services to the pharmaceutical and fine chemicals industry in Puerto Rico. John Brown brings world-class technologies; a global information and communication network; and extensive validation, construction management, and process-engineering expertise to the agreement. At the same time, Lebron provides a thorough understanding of Puerto Rico's environmental issues and architectural and engineering requirements. Through this arrangement, the team addresses the rapidly changing and more competitive conditions facing the pharmaceutical industry in Puerto Rico by delivering more cost-effective and sophisticated facilities on a faster schedule.

Forming contractor alliances is just one way contractors are trying to tap the brisk growth in demand for chemicals in select areas outside the U.S., such as the Pacific Rim and Latin America. They recognize that to compete on the global playing field they must be as international as their clients.

"You have to understand the various government regulations, financing issues, and market dynamics unique to each area if you want to win projects," says Oliver. In keeping with that philosophy, Bechtel just completed a market study for Thailand's government suggesting which ethylene-based chemicals and plastics the country should be most interested in expanding into so that it can build an infrastructure. "This work is extremely resource-intensive," he says, "but there's no shortcut for it."

John Brown's Rosenfeld echoes this point. Contractors must know the local customs and consider, for example, the religious mix of a region in hiring and training workers. John Brown recognizes the importance of having people native to a region in sites and managing offices. Having grown by acquisition, the company and and its parent, London-based Trafalgar House Engineering, now own a great number of small sites around the globe. Most of their rivals, in contrast, have a small number of very big sites. "So having a local presence is one of our strengths," says Rosenfeld.

At the same time, John Brown knows it's not practical or economically feasible to put experts in every aspect of engineering at every one of its 35 major offices in 30 countries. It needs the local element, but it also needs to link those regions so that expertise is readily accessible to all its engineers. With this consideration in mind, the firm has developed a high-speed computer network that links all the company's sites so that they operate as one global office, says Bill Mitchell, information technology program manager at John Brown in Houston.

Although the network has been in operation for roughly five years, just this past September, the company added some more powerful components that allow engineering applications to be transmitted over the network. One application, called Engines, enables employees on different continents to work simultaneously on different stages of a project rather than doing them in sequence, says Mitchell. As a result, John Brown can essentially put in a 24-hour workday for its clients. For example, an engineer in London can check and correct the work of a colleague in Houston by using on-line annotation or pasting on an electronic note while the engineer in the U.S. sleeps.

With this system, John Brown has been able to reduce project timetables and serve clients from anywhere in the world. It also saves on travel costs and cuts down on the number of costly mistakes, because the system can be programmed to check safety and design specifications, he says.

Van Sickels: business is turning around

Engineering firms' leadership in these types of technologies is becoming an increasingly important criterion for chemical companies, says DuPont's Kleinfelter. For example, John Brown's information technology capabilities were an important element in DuPont's decision just a few months ago to contract with JBEK—an alliance formed between John Brown and BE&K, a Birmingham, Ala., construction firm. "We want the engineering firms we work with to bring information technology, networks, and 3-D design capabilities to our business to help us reduce the overall cost and cycle time of our engineering and construction work while increasing its quality," says Kleinfelter.

In another move aimed at gaining an edge in the chemical market, contractors have had to change the way they bid for projects. Instead of bidding on a cost reimbursement basis (giving an estimate of costs up front and being compensated for any costs over that estimate), clients now want contractors to bid on a lump-sum amount and absorb any additional costs over the initial figure. "They are asking us to lay it on the line, give a competitive low bid to win the project, and take all the risk," Oliver says. "All firms like ours must operate this way to compete."

Because lump-sum bidding allows a client to lock in its total-cost figure early on, it makes it easier for the client to secure financing. Clients are also looking to engineering firms to help them with their financing plans in a more direct way. For example, a client might go as far as asking a contractor to take an equity interest in a project or even help arrange financing, says Oliver. "They want us to be a full-service house—to provide whatever they need to do a particular project."

Another way contractors hope to woo prospective clients is by earning credentials for international quality management standards. Chemical companies in the U.S. are not yet requiring ISO 9000 registration as a prerequisite to bidding on a project, but contractors anticipate that this will occur in the near future. "We viewed [not being ISO certified] as a threat to our business," says Kellogg's Van Sickels, noting that in June Kellogg became one of only a few contractors to receive ISO 9001 certification across the broad spectrum of contractor capabilities.

Engineering firms' new slate of services and marketing tools—from ISO standardization to information technology to alliances—have to be much more than gimmicks, says Rosenfeld. They have to be effective in helping improve investment productivity for the client, he adds. "The bottom line is that we have to get costs down and build plants faster. To compete in this market, you've got to have all the bells and whistles and the low price, too." □

C&EN staff photo

Rosenfeld: services must not be gimmicks